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ABSTRACT

Mobile technology shows promise in supporting and improving education and its delivery. Coupled with the use of mobile devices and software/hardware solutions that make it possible to access educational content, students can be exposed to new educational experience. Applications of mobile technology in education can provide many benefits including greater flexibility, more available education resources, as well as greater convenience, accessibility and responsiveness. As a new phenomenon that will be widely used and adopted in the years to come, the values of mobile technology in education should be better understood and researched. This research outlines our empirical study to examine the values of mobile education from the students' and instructors' perspectives. We will employ the Value-Focused Thinking approach to interview subjects and identify their values in mobile education. The result of this research will be presented in the form of a means-ends objective network that captures the values of mobile education and depicts the relationships between these values. The means-ends objective network can provide a conceptual foundation for future studies; it can also benefit the practitioners by providing guidelines for implementation of mobile technology in education.

Keywords

Mobile technology, education, value-focused thinking

INTRODUCTION

Mobile technology has extended access for desktop-based online virtual environment to handheld devices to support the process and delivery of education at any time and anywhere, which is sometimes called "mobile education" or "M-Education". Mobile education can be defined as "using any service or facility to provide a learner with general electronic information and educational content that aids in the acquisition of knowledge regardless of location and time" (Lehner and Hosekabel, 2002). Advances in mobile technology will accelerate the use of mobile devices significantly and encourage the use of mobile devices in educational settings.

With its unique features and functions such as mobility, reachability, localization, and personalization, mobile technology shows a lot of promise in supporting and improving education and in the delivery of education by providing greater benefits such as increasing availability of education resources, enabling more timely interaction, as well as providing greater convenience, accessibility and responsiveness. In an evaluation report by the Palm Education Pioneers Program, teachers' evaluation of mobile technology (using handheld devices such as Palm computers) was overwhelmingly positively - 96.5% of them indicated that they believed handheld computers were effective instructional tools and 93% believed that handheld computers contributed positively to the quality of learning activities that their students completed in the semester (Crawford and Vahey, 2002). Undoubtedly, mobile education is the next wave in the evolution of online education and will be a new way of learning in the near future.

Despite the tremendous potential of mobile technology in education, the area is still in the infancy stage and, therefore, the wide diffusion of mobile technology in education is littered with obstacles and challenges. The growth of mobile education will depend on the development and deployment of mobile technologies, which are still not mature enough at the current stage. The limitations of mobile devices also pose some challenges in terms of usability and ease of use. For example, the computational power tends to be so limited that multimedia capability is restricted; input mechanism can be awkward; and the relatively small screen size makes it hard to read information on the display (Soloway *et al*., 2001).

Therefore, in order to extend current education related activities into the mobile context, it is important to understand their potential values to users. More importantly, we need to determine the benefits and problems of using mobile technology in educational settings from students' and instructors' perspectives, to discover issues that are important for adoption and diffusion of mobile education applications, and to provide implications and guidelines for future development of mobile education applications.

LITERATURE REVIEW

Information technology has long been recognized as an important factor that can enhance and enrich education. The revolution of information technology has impacted processes of learning and teaching in educational settings and has become an integrated part of educational institutions and training facilities. Studies have been done to assess the impact of various information technologies on education.

Leidner and Jarvenpaa (1993) examined the use and outcomes of computer-based instructional technology in the context of graduate business education. They identified four primary uses of computer-based technology: (i) a means of interactive guided learning of technical procedures necessary for mastering the analysis of a subject, (ii) a means of real-time manipulation and analysis of data to provide the basis for conceptual and exploratory learning during class, (iii) a lab where students can work individually or in pairs until they need the instructor's help, (iv) a display mechanism – a replacement of transparencies, slides or blackboards.

In another paper by Leidner and Jarvenpaa (1995), they categorized the different usage of information technology in education as follows: (i) automate — set up automated classrooms, (ii) informate up — provide access of information to instructors, (iii) informate down — provide students with greater access to information, and (iv) transform — provide virtual continuous learning spaces.

While Leidner and Jarvenpaa (1993, 1995) identified the general impact of information technology on education, other researchers have evaluated the use of information technology in some specific contexts. For example, Alavi (1994) investigated the impact of an information technology – group discussion support system (GDSS) – on collaborative learning in a field setting. The results of the study indicated that GDSS-supported collaborative learning led to higher levels of perceived skill development, self-reported learning, and evaluation of classroom experience. Another study by Alavi *et al*. (1995) also suggested that distant students equipped with desktop videoconferencing exhibited higher critical-thinking skills than local groups.

Prior studies have investigated the usage of computer technology in learning, the general impact of computer technology in education, and the benefits of using information technology to support collaborative learning. Mobile technology, as an emerging technology, is expected to impact learning, enable a new way of learning, and provide new means of educational delivery.

Mobile technology provides some features and functions that facilitate learning and teaching in unique ways. Chen *et al.* (2002) identified some unique characteristics that are related to using mobile technology in educational settings; they are: (1) *Initiative of knowledge acquisition*. The information provided through mobile technology is based on the learner's request, that is, it is information on-demand. Based on the learner's needs, mobile devices and mobile technology can enable real-time display of information; (2) *Mobility of learning settings*. Mobile devices are portable, which allow the users to carry them around. Therefore, learning practices can take place at any time and at anywhere, such as on the road, at home, or at a coffee shop; (3) *Interactivity of learning process.* Through portable mobile devices and multi-media functions provided by these devices, students can communicate and interact with peer students, instructors, and experts more quickly and effectively; (4) *Integration of instructional content.* Mobile technology enables students to gain access to a variety of information and resources; therefore, it could support more complex learning activities by students.

This research examines the values of mobile technology in education. The results of the proposed study will serve two purposes: (i) validate prior literatures in the impact of information technology on education, and (ii) provide an empirical assessment of the values and potential of mobile technology in education.

RESEARCH METHODOLOGY

Keeney's (1992) Value-Focused Thinking approach will be used to identify the values of mobile technology in education. Value-Focused Thinking approach, which is fundamentally about deciding what is important and how to achieve it, defines essentially what the decision maker cares about (Keeney, 1992).

Justification of Research Methodology

To elicit the values of mobile technology in education, the best way is to ask the stakeholders, such as the students and instructors. Value-Focused Thinking provides a systematic approach for articulating and organizing values, which can lead to a more complete set of alternative solutions and a clearer understanding of how each alternative contributes to the achievement of objectives (Keeney, 1992). It allows us to articulate and thoroughly appraise the fundamental objectives in decision situations. Therefore, Value-Focused Thinking approach is very helpful and appropriate in determining the fundamental values and objectives that are always hidden. Value-Focused Thinking approach, in this sense, is an appropriate methodology for this research.

Steps of Value-Focused Thinking

The process of Value-Focused Thinking involves three main steps: (i) identifying values and converting them into objectives; (ii) structuring fundamental objectives and means objectives; and (iii) building the means-ends objective network.

Developing an initial list of objectives and converting them into a common form

Values are principles used for this evaluation. Values that are of concern are made explicit by the identification of objectives. An objective is a statement of something that one desires to achieve (Keeney, 1992). An objective is characterized by three features: a decision context, an object, and a direction of preference. In this step, one casts the decision maker values, which are typically expressed in various forms, into a coherent and consistent form. Several popular techniques that can help stimulate the identification of possible objectives include wish list, problems and shortcomings, alternatives, and consequence (Keeney, 1992).

Structuring objectives – fundamental objectives versus means objectives

After collecting the list of objectives, this step distinguishes between *fundamental objectives* and *means objectives*. Fundamental objectives concern "the *ends* that decision makers value in a specific context" whereas means objectives are "*methods to achieve ends*" (Keeney, 1994).

To separate means objectives from fundamental objectives and to establish their relationships, we use a test called "Why Is That Important?" For each identified objective, asking "Why Is That Important?" yields two types of possible responses. One is that this objective is one of the essential reasons for interest in the situation. This is called a fundamental objective. The other answer is that an objective is important because of its implications for some other objectives. This is called a means objective.

Building the means-ends objective network

The final step in the Value-Focused Thinking approach is to build the means-ends objectives network. This network provides a model that shows the specific interrelationships among the means objectives and their relationships to fundamental objectives. The means-ends relationships depicted in the model allow analysts not only to better understand the complexities of the value system of the parties involved, but also to select alternatives designed to achieve fundamental objectives via their effects on one or more means objectives.

Preliminary Results

Using the Value-Focused Thinking approach, we carried out pilot interviews to identify values of mobile education from both the students' and instructors' perspectives. Although this is still a research-in-progress, based on the interview results, we found that mobile technology has tremendous implications and potential for education and can contribute to education in several ways:

- *Maximize education on demand.* With the ability to access educational materials at any time and any place, mobile technology makes educational resources more readily available and accessible. Therefore, students can gain access to educational resources based on their personal needs and preferences.
- *Maximize virtual collaboration among students*. Virtual meetings through mobile devices and wireless services provide new means of collaboration to enhance learning. Mobile technology allows students to collaborate with peer students in less time and with fewer constraints.
- *Maximize organization of education activities*. Mobile devices usually have "personal digital assistant" functions which include scheduling, to-do list, and tracking. These functions make it easier for students to keep up with assignments and

homework, and to keep track of personal education activities; thus, they enable students to become better organized in managing and carrying out education activities.

- *Maximize immediate feedback*. Mobile testing or quizzes allow students to take tests using mobile devices to evaluate their understanding of course materials. Also, enhanced interaction using mobile technology enables students to ask instructors questions whenever the need arises (such as when they encounter a problem) and to get instantaneous or timely feedback from instructors.

FUTURE RESEARCH

Interviews are currently underway to gather students' and instructors' perspectives regarding values of mobile education. We will present the means-ends objective network derived from this study at AMCIS'04, which not only shows the objectives regarding values of mobile education, but also the relationships between these objectives (i.e., how one objective can be achieved through another).

Future research will be conducted with K-12 students and instructors to determine whether their values of mobile applications in education differ from those of the university settings, and if so, identify the specific factors that contribute to such differences. In this way, potential mobile applications for these settings can be proposed.

This research will be of significance and relevance to both academic researchers and industry practitioners. The value model we will derive from this research can serve as a conceptual foundation for future research in mobile education. This research is also beneficial to IT practitioners and educators in that it can provide directions for improving education and it highlights potential areas for mobile applications development.

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